

FACTORS DETERMINING PROFIT OF RUBBER AND OIL PALM SMALLHOLDERS IN BATANGHARI, JAMBI

FAKTOR-FAKTOR YANG MENENTUKAN LABA PADA PETANI KARET DAN KELAPA SAWIT DI BATANGHARI, JAMBI

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ABSTRAK

Rubber and oil palm are the priority plant for plantation smallholders in Jambi Province, particularly in Batanghari Regency. Land scarcity causes the competition of land use for rubber and oil palm plantation. Hence, the decision of land use is based on the differences of profit. The higher profits, the higher incentive to farmers for developing a commodity. Land scarcity also leads smallholders to improve both rubber and oil palm without use more land. Hence, it is important to analyze the determinant factors of profit in these commodities. Hence, the specific objectives were to identify factors determining rubber and oil palm smallholders profit in Batanghari, Jambi and to compare the profit generated by rubber and oil palm smallholder. Survey method was conducted from October to December 2012 through direct observation and interview techniques. Analysis method used in this research is ordinary least square (OLS) where this method is developed in two regression models and descriptive analysis. The results show that in rubber plantation, factors determining profit are land size, tree age, number of productive tree, district, farmer age, herbicide, and labor, while in oil palm plantation, factors influencing profit are tree age, number of productive tree, district, NPK, and herbicide. Based on average profit generated in planted period, oil palm plantations is more profitable than rubber plantation, they are Rp. 9.387.561,00 and Rp. 8.763.116,00 per ha per year, respectively.

Kata Kunci: Rubber, oil palm, ordinary least square, profit

ABSTRACT

Karet dan kelapa sawit merupakan tanaman prioritas bagi petani perkebunan di Provinsi Jambi, khususnya Kabupaten Batanghari. Langkanya ketersediaan lahan menyebabkan adanya kompetisi penggunaan lahan untuk perkebunan karet dan kelapa sawit sehingga keputusan dalam penggunaan lahan salah satunya dapat didasarkan pada perbedaan perolehan laba. Semakin tinggi laba, semakin tinggi insentif petani untuk mengembangkan komoditas tersebut. Keterbatasan lahan juga menyebabkan petani harus mampu mengembangkan kedua komoditas ini tanpa menggunakan lahan lebih banyak sehingga perlu analisis faktor-faktor yang mempengaruhi laba di kedua komoditas ini. Penelitian ini bertujuan mengetahui faktor-faktor yang mempengaruhi laba di kedua komoditas dan mengetahui komoditas mana yang memberikan laba lebih tinggi. Metode survei dilaksanakan melalui pengamatan langsung dan teknik wawancara mulai bulan Oktober sampai Desember 2012. Metode analisis yang digunakan dalam penelitian ini adalah ordinary least square (OLS) dengan mengembangkan dua model regresi dan analisis deskriptif. Hasil penelitian menunjukkan bahwa pada perkebunan karet, faktor-faktor yang mempengaruhi besarnya laba adalah luas lahan, umur pohon, jumlah pohon yang produktif, kecamatan, umur petani, herbisida dan jumlah tenaga kerja. Sedangkan pada perkebunan kelapa sawit adalah umur pohon, jumlah pohon yang produktif, kecamatan, NPK, dan herbisida. Berdasarkan rata-rata laba yang diperoleh sepanjang periode penanaman, perkebunan kelapa sawit memberikan laba yang lebih tinggi dari pada perkebunan karet, masing-masing sebesar Rp. 9.387.561,00 dan Rp. 8.763.116,00 per ha per tahun.

Keywords: Karet, kelapa sawit, ordinary least square, laba

INTRODUCTION

Oil palm and rubber is the priority plant of plantation farmers in Jambi Province. Based on production, productivity and land use, Batanghari regency is one of production centre of those commodities (BKPM, 2012). The high incentive of them induces the land use change in Jambi particularly from forest areas. BPS (2012) states that land uses of rubber and oil palm in Indonesia are increasing. The land scarcity phenomena lead the rubber and oil palm smallholders to compete each other to get more land or even to convert from one to another.

Some land use determinations are settlement history, agricultural intensification, non-traditional land use, crop productivity, tenure insecurity, fuel wood extraction and rural in-migration (Aguiar *et al.*, 2007). The monetary incentive is the most influencing factor which can determine the direction of land use changes.

Land scarcity phenomena also force smallholders to utilize the land as efficient as possible. They have to apply intensification and improve their cultivation system to increase rubber and oil palm profit without increasing the land requirement. Hence, determinant profit factors of rubber and oil palm profit are important to be analyzed.

Incentive of rubber and oil palm can be seen from their profit. The more profit generated, the more would beneficial incentive to deforest land for cultivation. It also indicates that profit will influence the direction of land use in Batanghari. Smallholders will give more concern to sector that give more income, even though, foreign scientists and Non Government Organizations (NGOs) have warned adverse environmental effects of deforestation (Feintrenie and Levang, 2009). Therefore, in order to know the direction of land use change in the future, it is required to analyze the profit of rubber and oil palm smallholders. Hence, the specific objectives were to identify factors determining rubber and oil palm smallholders profit in Batanghari, Jambi and to compare the profit generated by rubber and oil palm smallholder.

MATERIAL AND METHODS

This method was a part of research conducted by the Collaboration Research Centre (CRC) Goettingen University and Jambi University. The main data used in this research were secondary data which were the survey result collected by CRC team. The survey was conducted through direct observation and interview (Questionnaire) to 218 rubber farmer and 120 oil palm farmers in Batanghari, Jambi. Location was chosen through purposive sampling based on consideration that there are so many build rubber and oil palm plantation in Batanghari with high productivity. District and village were chosen through random sampling, while farmers were chosen through stratified random sampling because the number of farmers in every village is varied. Survey was conducted on October until December 2012. Survey data used in this research are production, input quantity used, cost, labor, land size, location, the number of tree and productivity tree and farmer characteristics.

Besides using survey result, this research also use supporting secondary data such as total land size, production, productivity of rubber and oil palm and also converted land in Jambi. The data were collected from some institution such as Province or Regency government and some official websites such as Statistics Indonesia and International Rubber Study Group. Literature reviews were also conducted to get other secondary data and more understanding.

OLS Method

Analysis was conducted by OLS method to produce two multiple regression models. Both models were used to see factors affecting profit in each plantation. Hence, rubber and oil palm data were used separately.

Constructing model was done by SPSS with Backward elimination technique. Backward elimination is a method of stepwise regression. This method tries to include all predictors, then eliminate nonsignificant predictor one by one, hence the rest predictors in last model are significant predictor (Whidiarso, 2010). By this model, we can know the coefficient (β_j) of each

significant variables. β_j explains the changes of dependent variable when one of independent variables changes with other independent variables hold constant.

The construction of model regression to explain factors determining profit are:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \mu_{it}$$

Where:

- Y = Profit generated by smallholders (Rp 000 per ha per year)
- X₁ = Land size (ha)
- X₂ = Tree age (year)
- X₃ = Number of productive tree (unit)
- X₄ = District (basis= Bathin XXIV, X₄₁= MuaraBulian, X₄₂ = Bajubang, X₄₃ = MaroSebolliir, X₄₄ = Pamayung). These district are selected randomly. This weighting is based on the order of district names listed in Batanghari BPS (BPS Batanghari Regency, 2013).
- X₅ = Farmer age (year)
- X₆ = Farmer education (year)
- X₇ = NPK (kg)
- X₈ = Urea (kg)
- X₉ = Herbicide (liter)
- X₁₀ = Labor (work day)
- β_0 = Intersep
- β_n = Slope (n = 1, 2,)
- μ_{it} = Error term

Assumption Test

To generate valid regression model, the data have to be normally distributed and OLS estimator has to be free from heteroscedasticity and multicollinearity. To prove that data are normally applied, Normal Probability Plot of regression was used. The scatterplot was applied to estimate the valid OLS estimator without heteroscedasticity. At the same time, the model had no multicollinearity since all variance inflation factors (VIF) provided by SPSS are less than 5.

Hypothesis Test

The t and F test were used to interpret which variables significantly determine rubber and oil palm smallholder's profit (Wooldridge, 2006). Besides, *goodness of Fit or R-square (a proportion of the total variation in Y that can be attributed to variations in all the explanatory variables acting together (Thomas, 1997) was also measured.*

RESULT AND DISCUSSION

Factors Determining Rubber and Oil Palm Smallholder's Profit

Backward regression technique was able to generate a regression model through some elimination steps. Model 1 was produced through 5 elimination steps, while model 2 was generated through 8 elimination steps. The goodness of fit can be seen from R-square value of each model. Model 1 has R-square of 0,577 meaning that 57,7% of profit variations generated by rubber farmer can be explained by model, while 42,3% of them are explained by error. On the other hand, model 2 has R-square of 0,687 meaning that 68,7% profit variations generated by oil palm farmer can be explained by model, while 31,3% of them are explained by error. R-square value in both models is not high enough. That means that there are several other variables influencing profit have to be included to the model. But those do not express that the regression models are useless, the low R-square values in social analysis with using cross section data are common.

Assumption test conducted to both models show that the residual in the model has spread normally. It can be seen in the Normal Probability Plot which is equal to straight line (Appendix 1). If the residual data origin from normal distribution, the data distribution value will be located in straight line (Santoso, 2009). These models also free from multicollinearity problem, since VIF value in every variable less than five. Usman and Nachrowi and Usman (2006) stated that multicollinearity occurs if VIF value is more than five. Besides, these models do not experience heteroscedastisity problem since the scatter plot (Appendix 2) shows that the residual both models spread randomly (Santoso, 2009).

According to F test, P-value (0,000) of both models are less than their confident interval (0,10). It indicates that in the case of multiple hypothesis, both models stated that all variables jointly affect the rubber and oil palm profit, either in model 1 or model 2. By this test we want to know whether a group of variables has no effect on the dependent variable (Wooldridge, 2006).

Based on backward regression, the best model 1 consists of 8 significant variables such as

plot size, tree age, number of productivity tree, farmer age, urea, herbicide, labor and district (MuaraBulian and Bajubang). On the other hand, the best model 2 consists of five variables such as tree age, number of productivity tree, NPK, herbicide, and district (Bajubang and MaroSebollir). Significance of these variables can be seen from t test. P-values of each variable are less than the confident interval (0,10).

Land size is a variable which significantly influence profit of rubber smallholder, but it does not significantly influence oil palm smallholder. Land size coefficient in model 1 is -659,556. It means that if land size increase 1 ha, then profit will decrease of Rp 659.556,00 per ha per year. This result is in line with Ellis (1996) which was stated that there was an inverse relationship between farm size and productivity. Usually, farmers with larger plot size will tend to do extensification, then they will use less input or labor per ha. Besides, it might be caused by inefficient of land use due to less control to use production factors, labor scarcity, and capital limitation.

Number of productive trees significantly determine rubber and oil palm profit. The number of productive tree coefficient in model 1 is 20,310. This coefficient means that if productive rubber tree increases 1 unit, it will increase profit of Rp. 20.310,00 per ha per year. The number of productive tree coefficient in model 2 is 81,457. This coefficient means that if productive oil palm tree increase 1 unit, it will increase profit of Rp. 81.457,00 per ha per year.

In district variables, there are 2 districts which significantly influence rubber and oil palm smallholder's profit. Based model 1 Bajubang is significantly lower than Bathin XXIV as basis. Besides, based on model 2 MaroSebollir is significantly higher than Bathin XXIV as basis. These results are in line with BPS Batanghari data (2013).

Tree age significantly affects profit of rubber and oil palm smallholders. Tree age coefficient in model 1 is 1.708. It means that if tree age increases 1 year, the profit of rubber smallholders will increase of Rp. 1.708,00 per ha per year. Tree age coefficient in model 2 is 11.351. It means that if tree age increase 1 year, the profit

of oil palm smallholders will increase Rp. 11.351,00 per ha per year. Even though we know that after certain years there is declining period. The positive impact shows that most rubber trees in Batanghari are still in productive period. It is in line with the data in which about 71% of rubber trees are in a production period (6-30 years) and 70% of them are in early of productive tree (6-18 years). Tumanggor (2009) stated that, statistically, the plant age significantly affected production with positive sign, because by the time research was conducted, the plants had the ideal age to bring out product. In the oil palm production, the 7-11 year-group plant significantly produces maximum amount of fresh fruit bunches (Prihutami, 2011).

Farmer age is the only farmer characteristic which significantly affect the rubber smallholder's profit. This variable does not significantly influence oil palm smallholder's profit because most oil palm smallholders, either old one or young one are transmigrant people origin from out of Jambi. They joined the transmigration program which were conducted gradually from 1905-1994. The biggest number of transmigrant movements was in the 1979-1984 and 1984-1989 period, which also the period of oil palm introduction. Regarding to the issue of transmigration, some programs provide agricultural facilities to support the transmigrants such as technology application training (Fearnside, 1997). Hence, most oil palm smallholders adopted the same technology and cultivation process. Different with oil palm smallholders, rubber smallholders tend to adopt various technology and cultivation process, for the example, applying clone or non clone seeds. Farmer age coefficient in model 1 is 79.257. That means that if farmer age increase 1 year, then farmer profit will increase Rp 79.257,00 per ha per year. This suggest that the older the farmer, the more experience they have. Then, the experience gives them more knowledge about how to manage the crop well and get better production and profit. This result is in line with Olujenyo (2008) stating that age and experience have positive impact to production.

Fertilizer such as NPK and urea are important input used for rubber and oil palm. In model 1, urea is a fertilizer variable which significantly influences the profit. Its coefficient is

2.547. It means that if urea applied increases of 1 kg per ha, then rubber smallholder's profit will increase of Rp. 2.547,00 per ha per year. Different with model 1, in model 2, NPK is a fertilizer variable which significantly affects the profit. Its coefficient is 3,914. It means that if NPK applied increases 1 kg per ha, then oil palm smallholder's profit will increase of Rp. 3.914,00 per ha per year. The differences of fertilizer type which significantly influence rubber and oil palm profit are caused by the differences of fertilizer needs in these plantations. Rubber tree use more single fertilizer, such as urea (Ikapi, 2008), while oil palm tree use more compound fertilizer, such as NPK (Jannah *et al.*, 2012) since urea is functioning for trunk and root growth whereas NPK is functioning for leaves, fruit, root, and trunk growth.

Herbicide applied significant influences farmer profit, either rubber or oil palm smallholders. Herbicide applied coefficient in model 1 is -161.473. It means that if herbicide applied in rubber plantation increases 1 liter per ha, then rubber smallholder's profit will decrease of Rp 161.473,00 per ha per year. Herbicide

coefficient applied in model 2 is -162.682. It means that if herbicide applied in oil palm plantation increases 1 liter per ha, then oil palm smallholder's profit will decrease of Rp. 162.682,00 per ha per year. This suggests that there has been ineffective herbicide use since its use which is too much is not followed by the high increasing of production even it decrease the production of oil palm.

Labor is important input in rubber and oil palm smallholders. This variable only significantly influences rubber smallholder's profit, while it does not determine oil palm smallholder's profit. It is caused by labor need differences in both plantation. Technically, rubber trees are needed to be tapped and collected more frequently (five days a week) fully by labor, than oil palm trees (twice a month) by labor and some equipment and vehicle. Although tapping rubber only needs a half day, this still needs more labor than harvesting oil palm (Feintrenie and Levang, 2009). Labor coefficient in model 1 is 27.225, meaning that if labor increases of 1 work day, then profit of rubber smallholders will increase of Rp. 27.225,00 per ha per year.

Table 1. Estimated values on factors determining profit of the rubber smallholder

Tabel 1. Nilai estimasi faktor-faktor yang menentukan laba pada petani karet

Variable	Coefficient	t-stat	P-value
Land size (ha)	-659,556	-2,899	0,004
Tree Age (year)	1,708	1,716	0,088
Number of productive tree (unit)	20,310	6,860	0,000
District			
MuaraBulian	1787,446	1,839	0,067
Bajubang	-2912,525	-2,756	0,006
Farmer age (year)	79,257	2,254	0,025
Urea (kg)	2,547	1,998	0,047
Herbicide (liter)	-161,473	-1,939	0,054
Labor (work day)	27,225	3,324	0,001
Weighted Statistics			
R-square = 0, 577		Prob (F _{stat}) = 0, 000	

Table 2. Estimated values on factors determining profit of the oil palm smallholder

Tabel 2. Nilai estimasi faktor-faktor yang menentukan laba pada petani kelapa sawit

Variable	Coefficient	t-stat	P-value
Tree age (year)	11,351	2,974	0,004
Number of productive tree (unit)	81,457	7,440	0,000
District			
Bajubang	-2891,817	-1,935	0,055
MaroSebolir	5074,305	3,667	0,000
NPK (kg)	3,914	3,418	0,001
Herbicide (liter)	-162,682	-1,877	0,063
Weighted Statistics			
R-square = 0, 687		Prob (F _{stat}) = 0, 000	

Effect of Crop Selection

Crop selection is the important determinant causing a different amount of profit. Furthermore, the crop selection determines the direction of land use change, whether it goes to oil palm or rubber plantations. Based on average profit generated by each crop in planted period (1-30 year for rubber and 1-25 years for oil palm), oil palm plantation is more profitable than rubber plantation, they are Rp 9.387.561,00 and Rp 8.763.116,00 per ha per year, respectively. Some previous literatures also obtained the same result where return to land and return to labor of oil palm plantation are more than those of rubber plantation (Belcher *et al.*, 2004; Wulan *et al.*, 2006; Papenfus, 2008; Feintrenie *et al.*, 2009). Moreover, this can be a foundation of land use change direction in which the existing land will be used for build up oil palm plantations more than rubber plantation. Then, if it is continued to occur, the rubber plantations will be converted to oil palm plantations.

CONCLUSION

Factors affecting rubber smallholder's profit are land size, tree age, number of productive tree, district (MuaraBulian and Bajubang), farmer age, urea, herbicide and labor. On the other hand, factors affecting oil palm smallholder's profit are tree age, number of productive tree, district (Bajubang and MaroSebolir), NPK and herbicide. Besides, crop selection influences amount of profit generated by farmers in Batanghari, Jambi. Oil palm plantation is more profitable than rubber plantation, they are Rp 9.387.561,00 and Rp 8.763.116,00 per ha per year, respectively.

REFERENCES

- Aguiar, A. P. D., G. Câmara, and M. I. S. Escada. 2007. Spatial statistical analysis of land-use determinants in the Brazilian Amazonia: Exploring intra-regional heterogeneity. *Ecological Modelling* 209 (2-4): 169–188.
- Belcher, B., Rujehan, N. Imang, and R. Achdiawan. 2004. Rattan, rubber, or oil palm: Cultural and financial considerations for farmers in Kalimantan. *Economic Botany* 58 (supplement): S77-S87.
- BKPM. 2012. Potensi Kelapa Sawit dan Karet di Kabupaten Batanghari. BKPM - Indonesia Investment Coordinating Board. <http://regionalinvestment.bkpm.go.id/> [June, 14, 2013].
- BPS. 2012. Luas Tanaman Perkebunan Besar Menurut Jenis Tanaman, Indonesia (000 ha), 1995-2012. BPS - Statistics Indonesia. <http://www.bps.go.id/> [June, 20, 2013].
- BPS Batanghari. 2013. Produksi Karet dan Kelapa Sawit (kg) Per Tahun 2012. Data Pusat Statistik. Batanghari.
- Ellis, F. 1996. Farm Households and Agrarian Development. 2nd. Edition. Cambridge University Press. Great Britain
- Fearnside, P. M. 1997. Transmigration in Indonesia: Lessons from its environmental and social impacts. *Environmental Management* 21 (4): 553-570.
- Feintrenie, L. and P. Levang. 2009. How to influence oil palm development in order to make it benefit local people and prevent uncontrolled deforestation? The example of Bungo district, Indonesia. Paper Presented at the XIII World Forestry Congress, Buenos Aires. Argentina, 18-23 October 2009.
- Feintrenie, L., W. K. Chong, and P. Levang. 2009. Why do farmers prefer oil palm? Lessons learnt from Bungo District, Indonesia. *Small-scale forestry* 9 (3): 379-396.
- Ikapi. 2008. Panduan Lengkap Karet. Penebar Swadaya. Jakarta.
- Jannah, N., A. Fatah, and Marhannudin. 2012. Pengaruh macam dan dosis pupuk NPK majemuk terhadap pertumbuhan bibit kelapa sawit (*Elaeisguineensis* Jack). *Media Sains* 4 (1): 48-54.
- Nachrowi, D. dan H. Usman. 2006. Ekonometrika untuk Analisis Ekonomi dan Keuangan, Pendekatan Populer dan Praktis. Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia. Jakarta.
- Olujenyo, F. O. 2008. The determinants of agricultural production and profitability in Akoko Land, Ondo-State, Nigeria. *Journal of Social Science* 4 (1): 37-41.
- Papenfus, M. M. 2000. Investing in Oil Palm: An Analysis of Independent Smallholder Oil Palm Adoption in Sumatera, Indonesia. Southeast Asia Policy Research Working Paper No. 15. ICRAF Southeast Asia. Bogor.
- Prihutami, D. N. 2011. Analisis faktor penentu produksi Tandan Buah Segar (TBS) tanaman kelapa sawit (*Elaeisguineensis* jacq.) di Sungai Baur Estate (SBHE), PT Bumitama Gunajaya Agro (PT BGA), Wilayah VI Metro Cempaga, Kotawaringin Timur, Kalimantan Tengah. Bachelor Bogor Agricultural University. Bogor.
- Thomas, R. L. 1997. Modern Econometrics an Introduction. Addison Wesley Longman. London.

- Tumanggor, D. 2009. Analisis faktor-faktor yang mempengaruhi produksi coklat Di Kabupaten Dairi. Master Thesis North Sumatera University. Medan.
- Santoso, S. 2009. Menguasai Statistik dengan SPSS 17. Elex Media Komputindo. Jakarta.
- Wooldridge. 2006. Introductory Econometrics, A Modern Approach. 3rd. Edition. Thomson South-Western. Toronto.

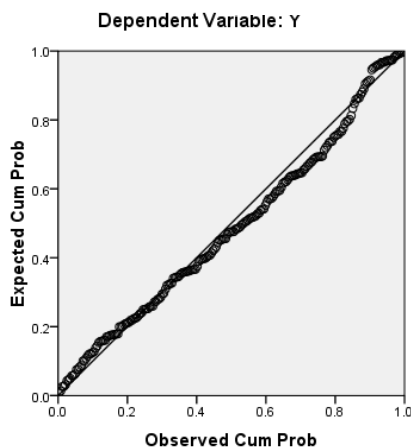
Whidiarso, W. 2010. Berkenalan dengan Metode-Metode Analisis Regresi melalui SPSS. Yogyakarta: UGM. http://widhiarso.staff.ugm.ac.id/files/widhiarso_2010_-_berkenalan_dengan_metode_regresi.pdf. [October, 15, 2013]

Wulan, Y. C, S. Budidarsono, and L. Joshi. 2006. Economic Analysis of Improved Smallholder Rubber Agroforestry Systems in West Kalimantan, Indonesia - Implications For Rubber Development. Paper Presented at the Sustainable Sloping Lands and Watershed Management Conference. LuangPrabang, 12-15 December 2006.

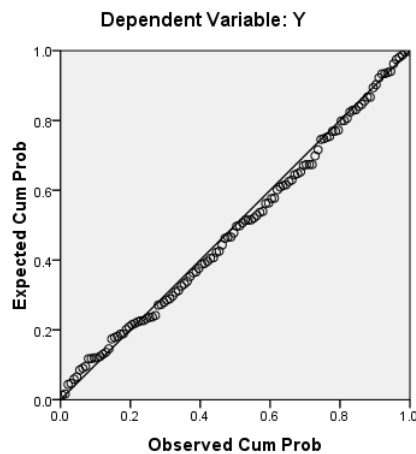
Appendix 1. Assumption Test to Model 1 and 2.

1. Normality Test

Normal P-P Plot of Regression



(b) Rubber

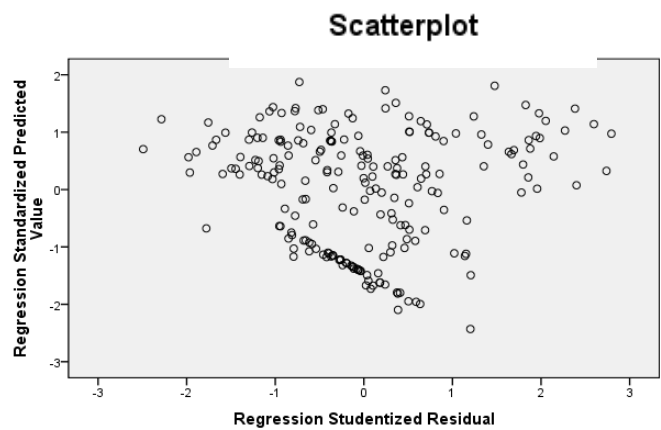


(a) Oil Palm

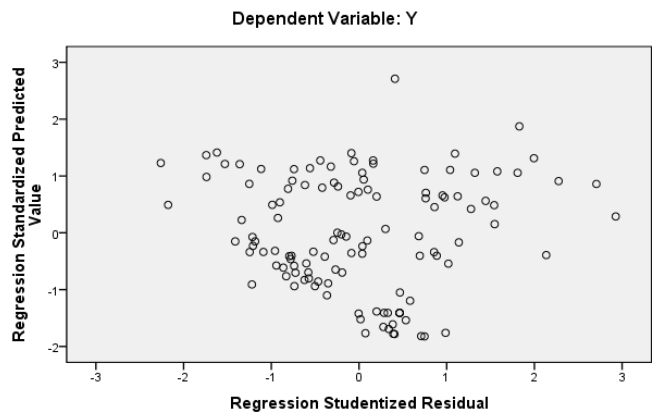
2. Multicollinearity Test

Variable	VIF	
	Rubber	Oil Palm
Land Size	1,171	-
Tree Age	1,242	1,710
No. of Productive Tree	2,254	1,459
District		
MuaraBulian	1,514	-
Bajubang	1,499	1,591
MaroSebolir	-	1,858
Farmer Age	1,291	-
NPK	-	1,102
Urea	1,092	-
Herbicide	1,195	1,083
Labor	2,488	-

3. HeteroscedastisityTest



(a) Rubber



(b) Oil Palm